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Prepared under authority of the
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by

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Stereoscopic Studies of Anatomy

Section X

Table of Contents

NORMAL ANATOMY OF TEMPORAL BONE AND INTERNAL EAR

No. 1.—Temporal Bone Topography. External Surface.
No. 2.—Mastoid Antrum Opening. Supra Meatal Square. Neres.
No. 3.—Simple Mastoidectomy. Operation for Acute Mastoiditis. (Schwartze Zaufal.)
No. 4.—Radical Mastoidectomy. Operation for Mastoiditis, Following Chronic Suppurative Otitis Media. (Schwartze-Stacke.)
No. 5.—Meato Mastoid Operation. Operation for the Cure of Chronic Supurative Otitis Media with Necrosis. (Stacke.)
No. 6.—Relation of Mastoid Antrum to Mastoid Process. Posterior View.
No. 7.—Descending portion of Lateral Sinus. Anteriorly placed.
No. 8.—Antral Tegmen Abnormally Low and Bulbous Knee of Sinus.
No. 9.—Abnormally Large Tip Cell. Inferior View.
No. 10.—Course of the Descending and Transverse Facial Canal.
No. 11.—Relation of Lateral Sinus Bulb to Descending Facial Canal.
No. 12.—Mastoidectomy. Danger Localities.
No. 13.—Relation of Descending and Transverse Facial Nerve to Horizontal or External Semicircular Canal and Oval Window.
No. 14.—Section through Annular Ring, Mastoid Antrum and Process.
No. 15.—Vertical Section. Inverse Tympanic View.
No. 16.—Ossicular Relation to Aditus Ad Antrum.
No. 17.—Vertical Transverse Section Through Tympanum and Mastoid Process.
No. 18.—Posterior Tympanic Wall Relation. No. 1.
No. 19.—Posterior Tympanic Wall Relation to Facial Canal and Mastoid Antrum. No. 2.
No. 20.—Relation of Ossicular Chain to Tympanum and Mastoid Antrum, Superior View.
No. 21.—Relation of Ossicles to Vestibule of Cochlea. Perpendicular Section.
No. 22.—Ossicular Relation to Tympanum. Tympanic View.
No. 23.—Ossicular Relation to Annular Ring. Inverse View,
No. 24.—Relation of Vestibule to Internal Auditory Canal. Inferior View.
No. 25.—Ossicular Relation to Cochlea. Tympanic View.
No. 26.—Relation of Semicircular Canals to Tympanum, Ossicles and Mastoid Process.
No. 27.—Relation of External Semicircular Canal to Fallopian Canal.
No. 28.—Relation of External and Superior Semicircular Canals to Ad-Aditus and Fallopian Canal.
No. 29.—Relation of Semicircular Canals to floor of Mastoid Antrum.
No. 30.—Cochlea Relation to Semicircular Canals. Superior View No. 1.
No. 31.—Cochlea Relation to Semicircular Canals. Superior View No. 2.
No. 32.—Cochlea Relation to Internal Auditory Canal and Semicircular Canals. Internal View.
No. 33.—Semicircular Canal Relation to Aqueductus Cochlea and Internal Auditory Canal. Posterior View.
No. 34.—Cochlea Relation to Posterior Tympanic Wall.
No. 35.—Cochlea Relation to Ossicles and Mastoid Antrum. Superior View.
No. 36.—Cochlea Relation to Internal Auditory Canal and Vestibule. Horizontal Section.

413
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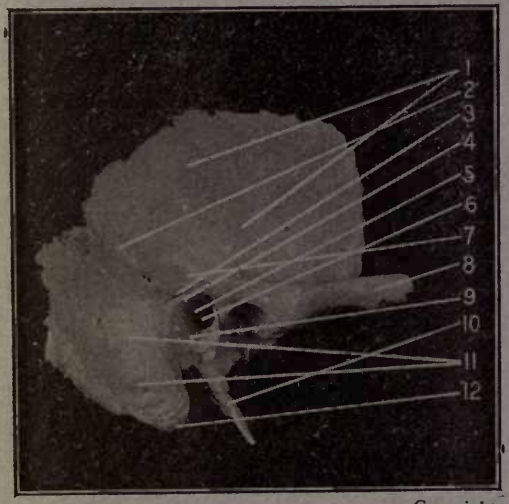
TEMPORAL BONE TOPOGRAPHY

EXTERNAL SURFACE. This external surface of the temporal bone is of extreme importance to the aural surgeon. It shows definite bony landmarks that are recognized while passing the fingers over the bone surface after the soft parts have been retracted. The area posterior and slightly superior to the auditory canal, in a radius of about 4 c.m., should always be viewed and felt before any bone operative work is commenced which will outline dangerous localities beneath the surface.

This bone is in every respect perfect, and normal according to measurement and ossification. All the depressions and eminences are readily discernible. Only the essential markings are given. The careful study of this bone facilitates the reading of the accompanying stereograms.

The relation of the auditory canal to the zygomatic root and mastoid ridge and process is well shown, also the mastoid fossa, a constant anatomical landmark is located 3 m.m. posterior to the posterior superior quadrant of the auditory canal; 6 m.m. from the zygomatic crest and 8 m.m. from the temporal ridge.



The figures indicate—

1—Squamous Portion
2—Temporal Ridge
3—Mastoid Fossa
4—Spine of Henle (Suprameatal Spine)
5—Annular Ring
6—Tympanum
7—Zygomatic Crest
8—Zygoma
9—Auditory Meatus
10—Styloid Process
11—Mastoid Process
12—Mastoid Tip

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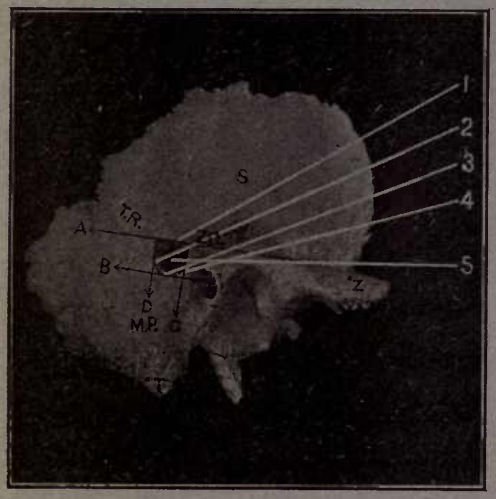
SECTION X NO.1.

Section X --- No.2

MASTOID ANTRUM OPENING

SUPRA MEATAL SQUARE. NERES. The location and entrance into the mastoid antrum is always necessary in every case where a mastoid operation is performed. The supra meatal square is constructed as follows: The superior limit line A of the square is made by extending the zygomatic ridge at the zygomatic crest Z C horizontally posterior to the distance of about one inch. *The inferior limit line B* is made by drawing a line from the center of the auditory canal also horizontally posterior and parallel to the superior limit line A. The *anterior limit line C* is made by dropping a line perpendicular to the superior limit line A at the zygomatic crest; this line passes through the anterior margin of the mastoid fossa and base of Henle's spine and bisects also the inferior limit line B. This line is tangent to the posterior wall of auditory canal. The *posterior limit line D* is made by taking a point 5 m.m. posterior to the anterior limit line C on the superior limit line A and dropped perpendicularly; this line is parallel to the line C, and also bisects the inferior limit line B. This forms a perfect 5 m.m. square. A square opening made within these borders will locate the mastoid antrum at a depth of 16 to 18 m.m.



The figures indicate—

1—Superior Limit Line
2—Posterior Limit Line
3—Inferior Limit Line
4—Anterior Limit Line
5—Mastoid Antrum Opening

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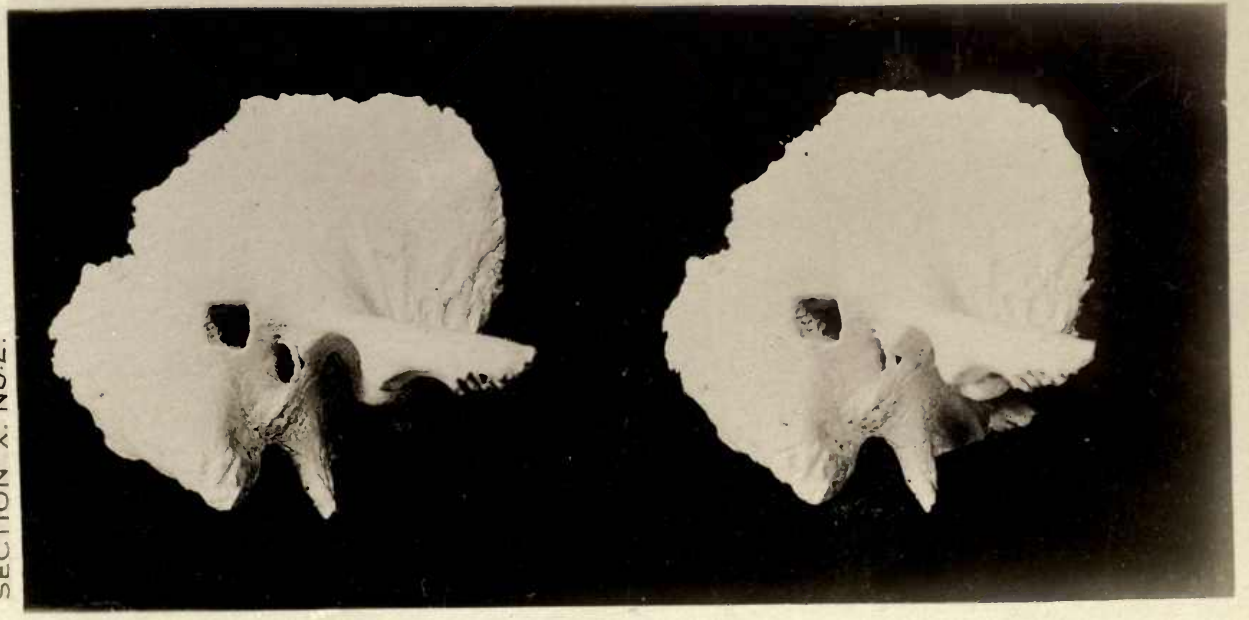


SECTION X. NO.2.

Section X --- No.3

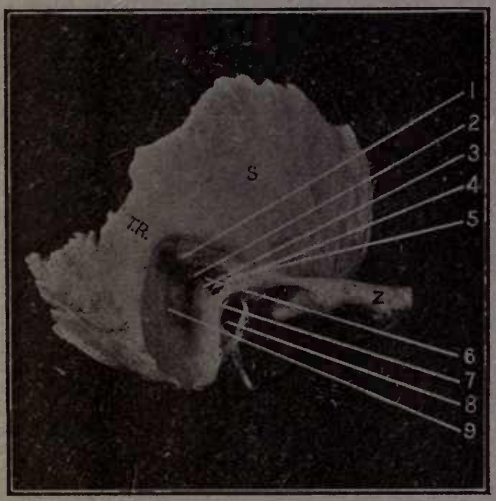
SIMPLE MASTOIDECTOMY

SCHWARTZE ZAUFAL

Operation for Acute Mastoiditis

This operation is performed after the mastoid antrum has been opened, as shown in stereogram No. 2. The entire external table is removed (never going above the superior limit line A of the square, see stereogram No. 2), including the mastoid tip, with complete ablation of all the mastoid cells (zygomatic, squamous and mastoid) enlarging the antral mouth of the aditus ad. antrum. Ossicles are not disturbed.

This specimen has been tilted slightly backward to show more distinctly the antral tegmen. The head of the malleus is just visible, anterior to the incus, and the short incal process as it lies in its groove on the aditus floor is easily seen.



The figures indicate—

1—Antral Tegmen
2—Mastoid Antrum (Floor)
3—Eminence Ext. Semi-Cir. Canal
4—Incus
5—Tympanic Tegmen
6—Aditus Ad. Antrum (Floor)
7—Posterior Wall of Auditory Canal
8—Tympanum
9—Prominence of Lateral Sinus

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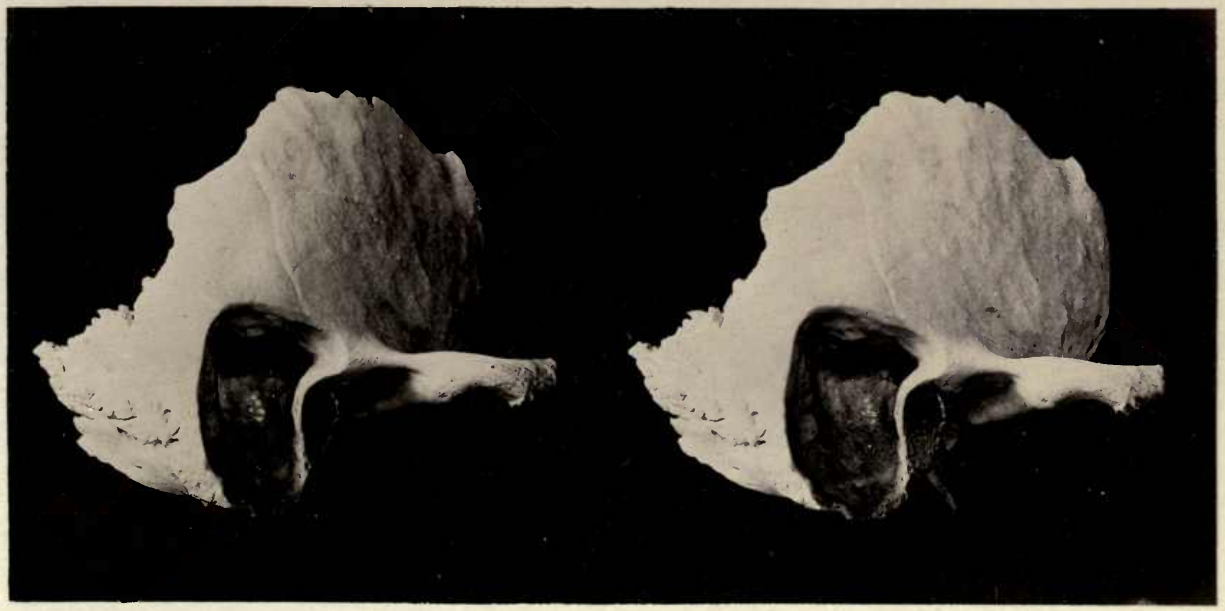


SECTION X. NO.3.

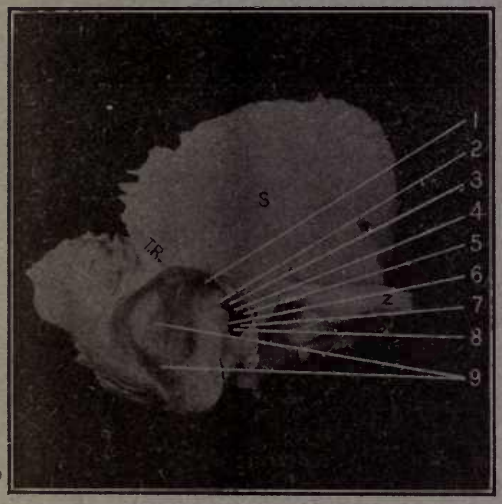
Section X --- No.4

RADICAL MASTOIDECTOMY

SCHWARTZE STACKE

Operation for Mastoiditis, following a Chronic Suppurative Otitis Media

The same general operative procedure is followed as illustrated in the preceding stereograms Nos. 2 and 3. A complete simple mastoid operation is performed; then the posterior superior triangular quadrant of the osseous auditory canal is removed down to the annular ring and including the external wall of the aditus. The incus and malleus are removed through this slit (5 m.m. wide). The stapes is undisturbed. The complete operation consists in converting the mastoid process, antrum, aditus ad. antrum, tympanic attic and tympanum proper into one continuous smooth cavity. Ossiculectomy of the malleus and incus.



The figures indicate—

1—Mastoid Antrum (Floor)
2—Eminence of Ext. Semi-Cir. C.
3—Aditus
4—Stapes
5—Fallopian Canal. Tympanic Turn.
6—Posterior Inferior Quad. and Meatus
7—Tympanum
8—Round Window
9—Prominence of Lateral Sinus

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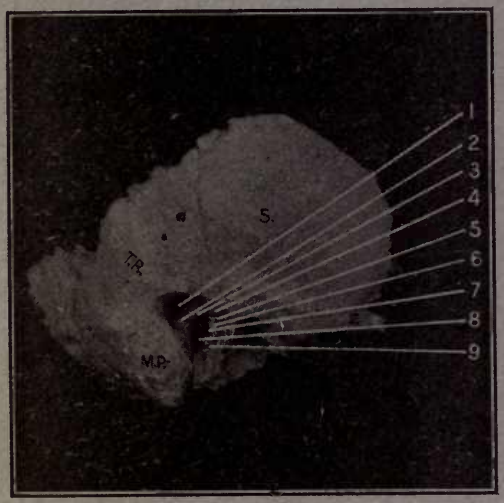
SECTION X. NO.4.

MEATO MASTOID OPERATION

STACKE

Operation for the Cure of Chronic Suppurative Otitis Media with Necrosis

Procedure differs materially from the foregoing ones in that the field of attack is located and confined to the antral and tympanic region. The mastoid antrum is found through the superior meatal square (see preceding stereogram No. 2). The posterior superior triangular quadrant of osseous auditory canal is removed to the depth of the annular ring (16 to 18 m.m.), including the external wall of the aditus. The malleus and incus are removed. Stapes left in situ. This forms into one continuous cavity, the mastoid antrum, aditus ad. antrum, tympanic attic and tympanum proper. The mastoid process with its cells is undisturbed.



The figures indicate—

1—Mastoid Antrum (Floor)
2—Eminence Ext. Semi-Cir. C.
3—Aditus
4—Fallopian Canal
5—Stapes
6—Promontory
7—Round Window
8—Posterior Inferior Auditory Wall
9—Tympanic Floor

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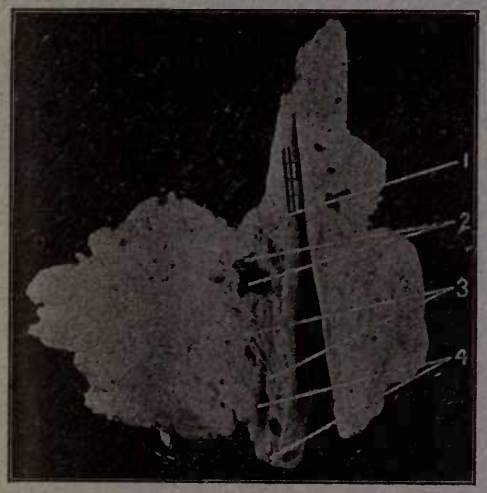
SECTION X. No.5

Section X --- No.6

RELATION OF MASTOID ANTRUM TO MASTOID PROCESS

POSTERIOR VIEW. A rectangular sawed section has been removed from the posterior and central portion of the mastoid process, including the posterior superior squamous portion. This antrum is rather large, cells leading from it are plainly visible. A thin perpendicular bony septum separating tip cell. No. 4. The bony lamina covering the mastoid antrum in this specimen is deeper than usual. No. 1.

The figures indicate—



1—Antral Tegmen
2—Antrum
3—Mastoid Cells
4—Tip Cell (Partitioned)

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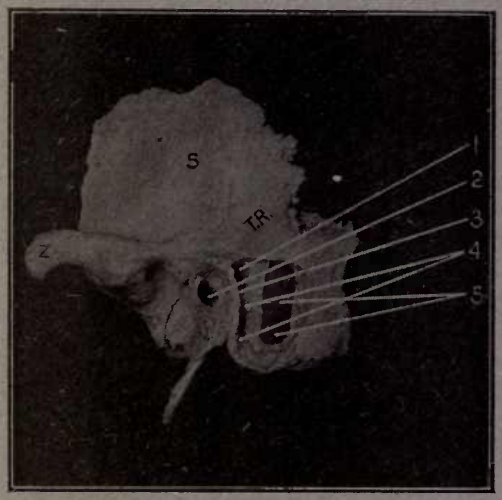
SECTION X. NO.6

Section X --- No.7

DESCENDING PORTION OF LATERAL SINUS

ANTERIORLY PLACED. The opening into the mastoid antrum in this specimen is very small (4 m.m.), due to the encroaching upon it of the lateral sinus in this region. The mastoid cells are few and shallow. The internal table, covering the lateral sinus, fills almost completely the entire posterior and central portion of the mastoid process. This sinus is very superficial to the external cortex, especially at its superior turn (2 m.m.).

The figures indicate—



1—Mastoid Antrum Opening
2—Tympanum
3—Posterior Auditory Canal Wall
4—Mastoid Cell Space Between Canal Wall and Lateral Sinus
5—Ascending Portion of Sinus

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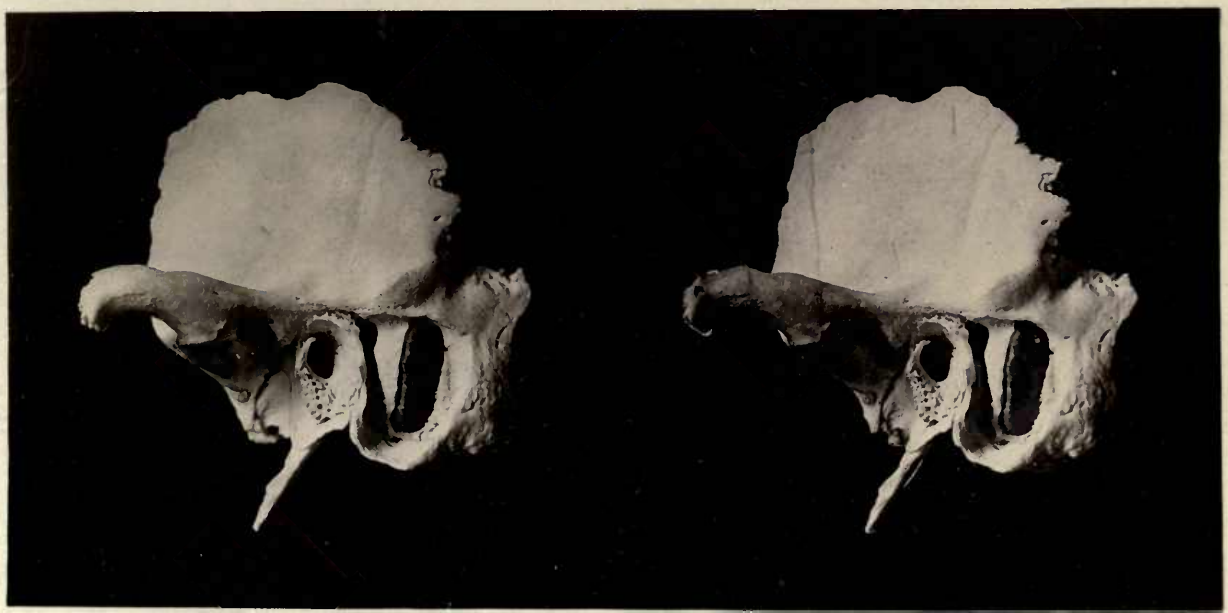
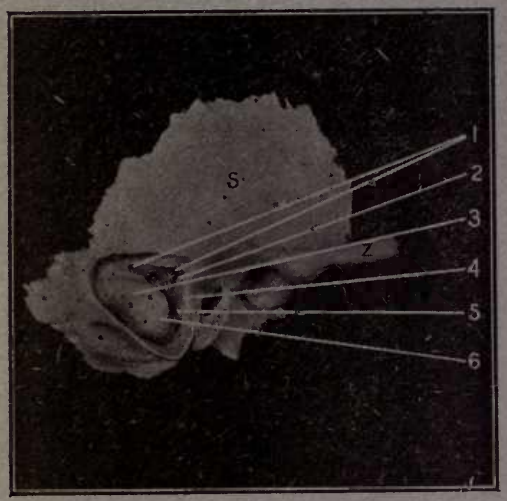


SECTION X. NO.7.

Section X --- No.8

ANTRAL TEGMEN ABNORMALLY LOW AND BULBOUS KNEE OF SINUS

This specimen graphically illustrates two most important structures encountered while ablating the mastoid cells, if located abnormally as shown in this specimen. The antral tegmen has been removed showing the dura beneath. The knee of the lateral sinus is seen centrally placed; also the posterior or lateral turn of the sinus as it passes back to the torcular herophili.



The figures indicate—

1—Antral Tegmen (Dura)
2—Mastoid Antrum (Floor)
3—Torcular Bend of Sinus
4—Posterior Auditory Canal Wall
5—Narrow Space Between Knee of Sinus and Auditory Canal
6—Ascending Sinus

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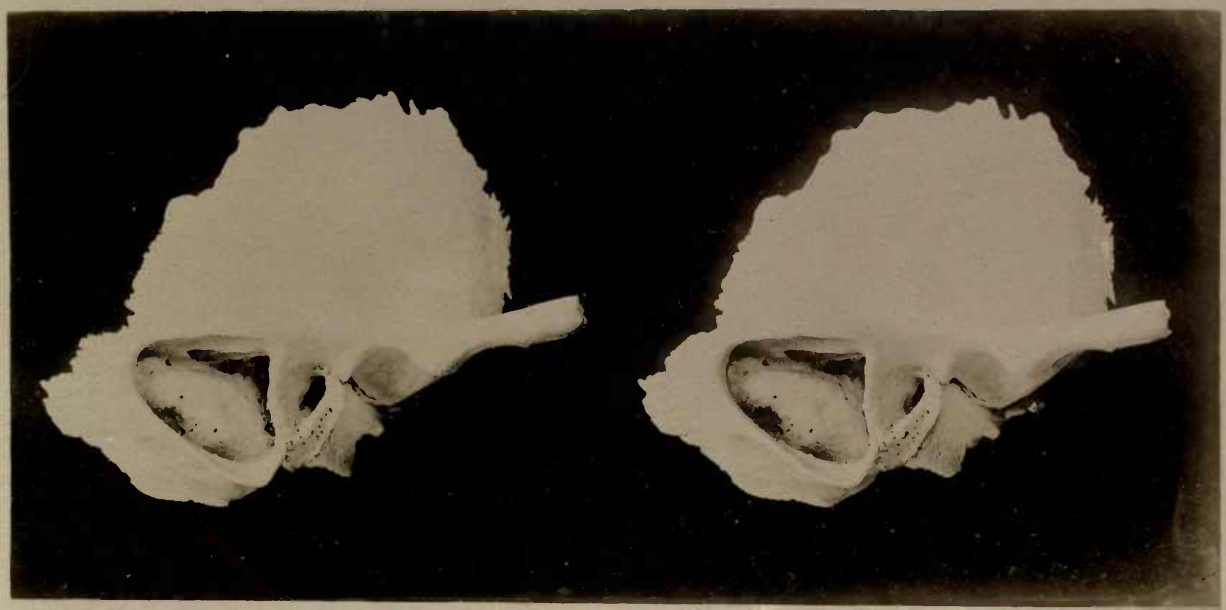
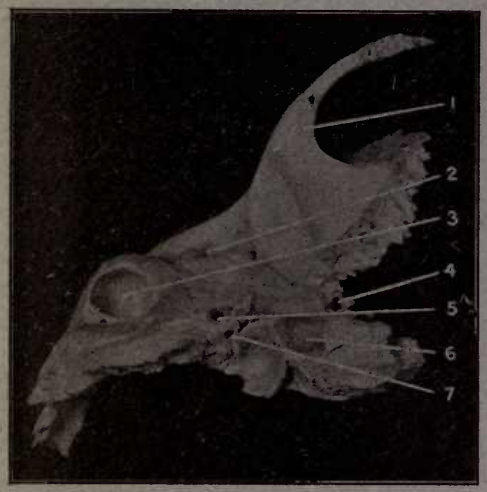


SECTION X NO8

Section X --- No.9

ABNORMALLY LARGE TIP CELL

INFERIOR VIEW. The tip of the mastoid process has been sawed transversely across, revealing a very large cell in this region of the mastoid process. This specimen illustrates how a large quantity of pus can collect and be confined in this portion of the temporal bone. The average mastoid process has a number of large cells at the tip, but rarely one of such extreme dimensions as shown in this specimen.



The figures indicate—

1—Zygoma
2—Auditory Meatus. External Surface
3—Large Tip Cell
4—Pharyngeal Mouth of Eust. Tube
5—Stylo Mastoid Foramen
6—Carotid Canal
7—Opening of Aqueductus Cochleae

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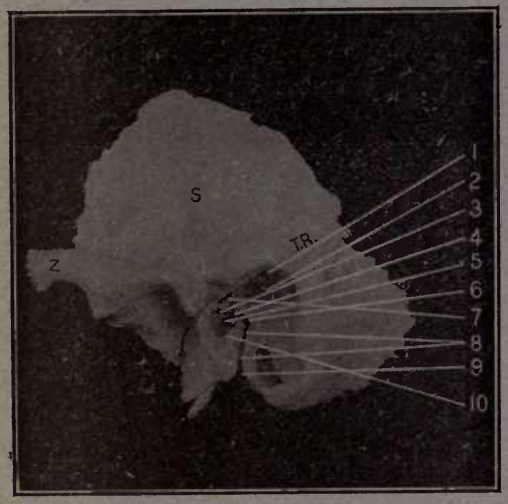
SECTION X. No 9

COURSE OF THE DESCENDING AND TRANSVERSE FACIAL CANAL

In this specimen the entire posterior osseous wall of the auditory canal has been removed down to the external bony covering of the facial canal (16 m.m.) The bony covering of the descending portion of the nerve canal has been drilled into throughout its entire course, beginning at the stylo mastoid foramen and through the fallopian canal, exposing it completely. The mastoid cells have been ablated in order to show the facial relation as regards depth from external surface (16 to 18 m.m.). The descending portion (15 m.m. long) runs perpendicular to and hugs the auditory meatus. The facial elbow is well shown. At this point (or the beginning of the fallopian canal) the nerve turns anteriorly, almost horizontally, passing across the posterior superior portion of the tympanic wall, a distance of 8 m.m. Only a thin lamina of bone (a fraction of a m.m. in thickness) separates the nerve from the upper boundary of the oval window.



The figures indicate—

1—Trephine Opening, through Antral Tegmen
2—Mastoid Antrum (Floor)
3—Ant. Tympanic. Facial Foramen
4—Transverse Facial Canal
5—Stapes
6—Facial Elbow
7—Trephine Opening through Tympanic Tegmen
8—Descending Facial Canal
9—Stylo Mastoid Foramen
10—Annular Ring

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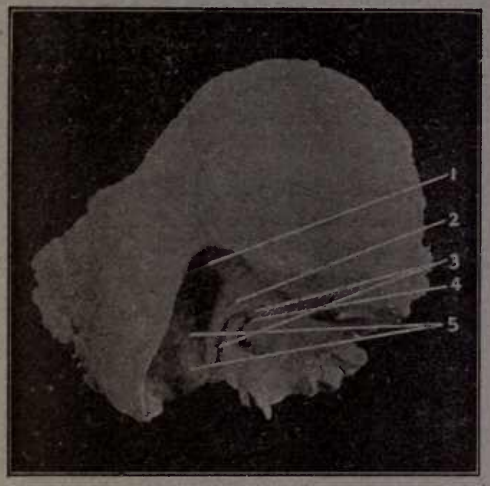
SECTION X. NO.10

RELATION OF LATERAL SINUS BULB TO DESCENDING FACIAL CANAL

The entire wall of the auditory canal, anterior portion and tip, bony covering and cells of the mastoid process, exposing the facial canal throughout its course, have been removed, illustrating the intimate relation of the sinus at the bulb to the descending facial canal. Caution should be exercised while removing a mastoid tip.



The figures indicate—

1—Mastoid Antrum
2—External Semi-Cir. Canal (Open)
3—Facial Canal
4—Oval Window
5—Lateral Sinus Bulb Portion

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SECTION X NO.11

MASTOIDECTOMY DANGER LOCALITIES

This temporal bone demonstrates the four cardinal danger localities while operating on the temporal bone. The *facial nerve* is seen as it enters and emerges from its opening in the anterior superior quadrant of the tympanic wall, passing backward almost horizontally, dropping vertical at the elbow, to the region of the stylo mastoid foramen. The (horizontal) *or external semi-circular canal* is opened, giving its relation to the floor of the aditus ad. antrum. The *antral tegmen* has been removed throughout its whole length. An external semi-lunar portion of bone has been chiseled away over the zygomatic root to show the tympanic floor of the middle cerebral fossa. The *lateral sinus* prominence in the posterior central portion of the mastoid process is in its normal location. The ossicular chain is in natural articulation.

The figures indicate—

1—Dura over Middle Cerebral Fossa
2—(Horizontal) or External Semi-Cir. Canal
3—Incus
4—Malleus
5—Stapes
6—Mastoid Antrum Floor
7—Lateral Sinus Horizontal (Turn)
8—Facial Nerve
9—Ascending Sinus Prom.

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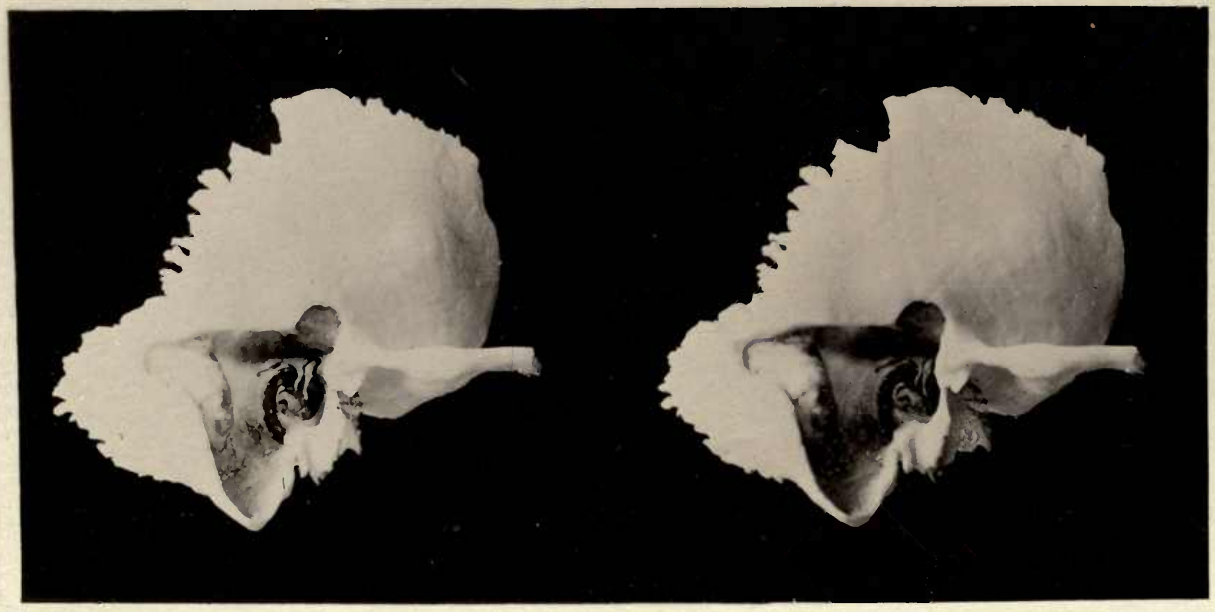
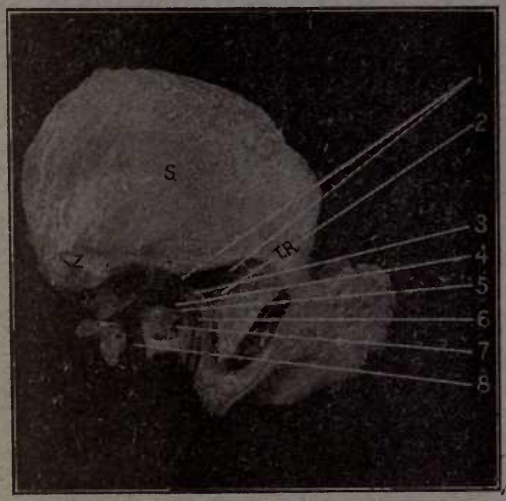


SECTION X. NO.12

RELATION OF DESCENDING AND TRANSVERSE FACIAL NERVE TO HORIZONTAL OR EXTERNAL SEMICIRCULAR CANAL AND OVAL WINDOW

This dissection is carried sufficiently far and to a greater depth than any of the foregoing serial specimens. The entire auditory canal has been removed to the level of the annular ring. The facial nerve has been exposed throughout its entire course. The same depletion of the mastoid cells, trephine openings have been made through tegmen, same as in Fig. 6. The external wall of the ext. semi-cir. C. (horizontal) is removed. It will be seen that the transverse portion of the facial nerve passes beneath and parallel to this semi-circular, and above and parallel to the oval window; the fallopian canal wall is all that separates them. The ascending portion of the carotid canal forms the anterior inferior boundary of the tympanic cavity. This specimen shows how easily the carotid artery can be injured while curetting the tympanic mouth of the eustachian tube, for the external inferior wall of the eustachian tube forms the external posterior wall of the carotid canal. This lamina of bone (½ to 2 m.m. thick) is all that separates the eustachian tube from the artery.



The figures indicate—

1—Trephine Openings through Tympanic and Antral Tegmen
2—Mastoid Antrum (Floor)
3—Horizontal or External Semi-Cir. Canal
4—Oval Window
5—Chorda Tympani Nerve
6—Facial Nerve
7—Round Window
8—Carotid Artery

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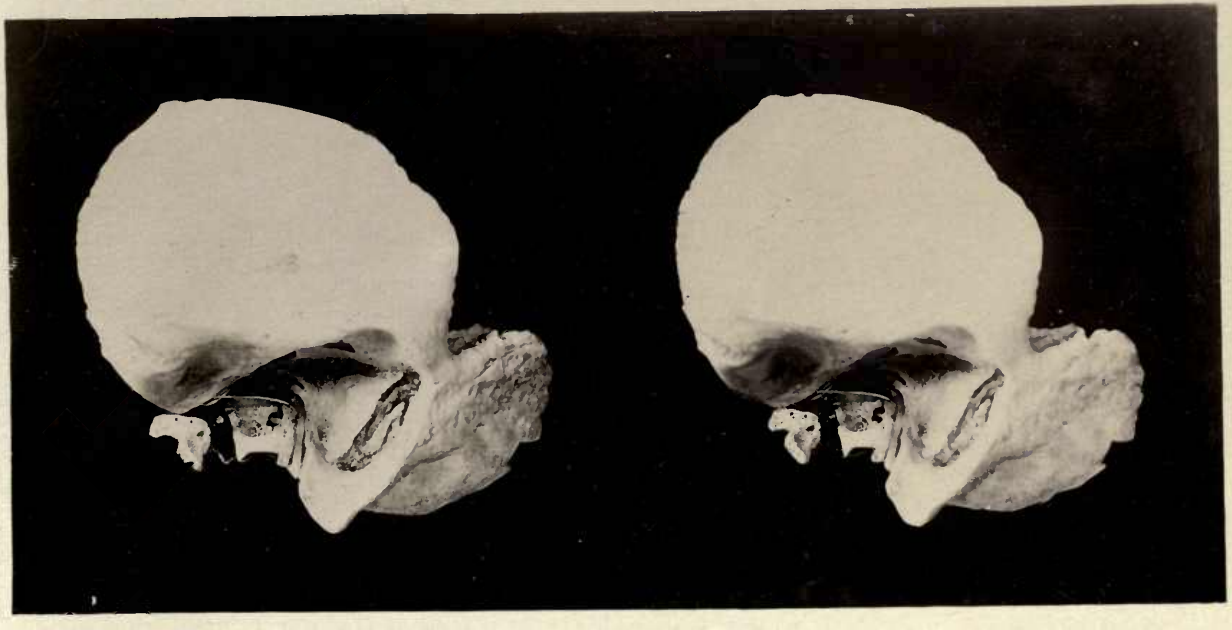
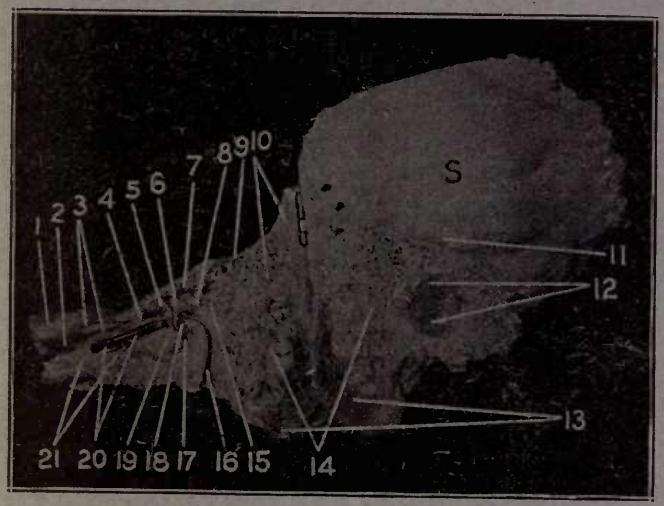


SECTION X. NO.13

TRANSVERSE SECTION THROUGH ANNULAR RING AND MASTOID ANTRUM AND PROCESS

This temporal bone has been cut in this locality in order to demonstrate the relation of the eustachian tube, ossicular chain, facial nerve, aditus, mastoid antrum and mastoid cells to tympanic cavity.

This specimen shows the numerous mastoid cells that may be present in the average mastoid process. These cells are encased in a rather thin cortex. The tensor tympanic muscle is well illustrated. The bony covering of the processus cochleariformis is removed, exposing the muscle its whole length. The tympanic tegmen presents on its tympanic surface a number of cell spaces. Two small recesses are within these cells for the reception of the head of the malleus and body of the incus. This bone gives the general temporal anatomy.



The figures indicate—

1—Petrous Tip
2—Carotid Canal
3—Greater and Lesser Superficial Petrosal Nerves
4—Anterior Tympanic Facial Foramen
5—Malleus
6—Incus
7—Tympanic Tegmen
8—Prom. for External Semi-Circular Canal
9—Antral Tegmen
10—Squamous Cells
11—Floor of Middle Cerebral Fossa
12—Annular Ring (Drum Attached)
13—Mastoid Tip
14—Mastoid Cells
15—Mastoid Antrum Floor
16—Descending Portion of Facial Nerve
17—Round Window
18—Stapes
19—Promontory
20—Tensor Tympani Muscle
21—Eustachian Tube

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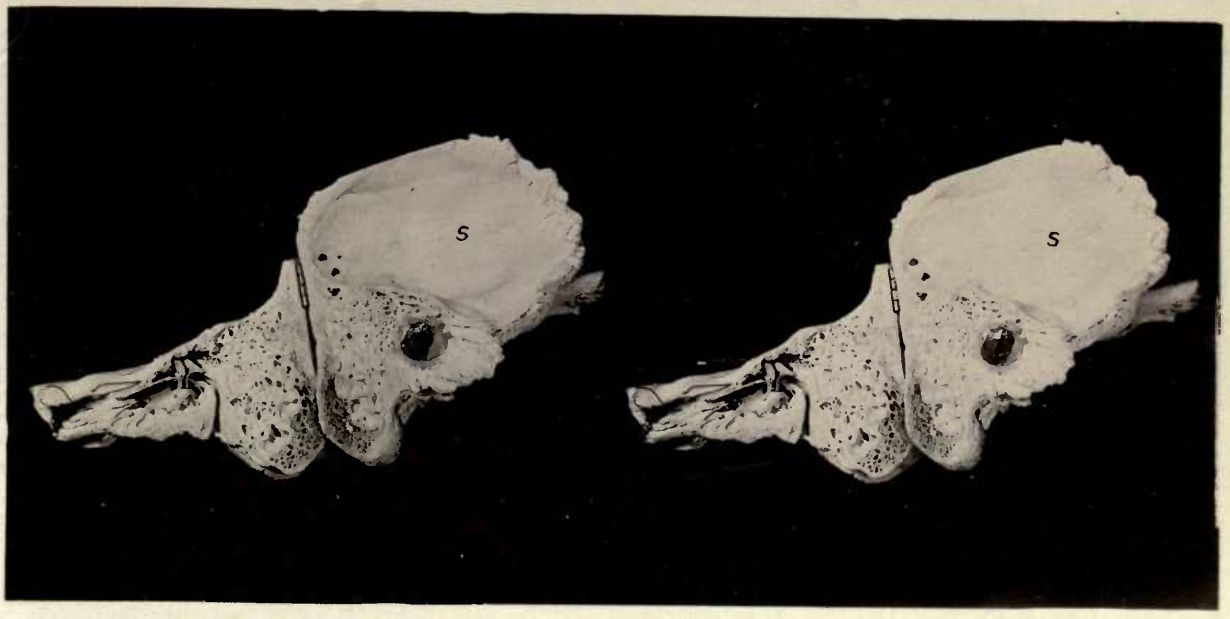
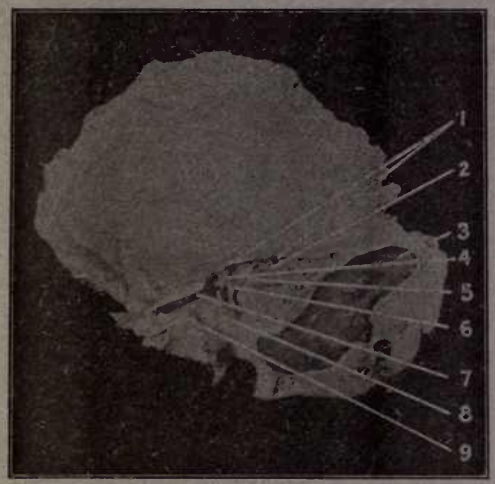


Section X --- No.15

VERTICAL SECTION

INVERSE TYMPANIC VIEW. This specimen has been sawed just internal to the annular ring, revealing uniform arching of tympanic and antral tegmen. The tympanic membrane is in position and attached to the annular ring and anterior surface of the manubrium of the malleus. The smooth external surface of the aditus ad. antrum; above and posterior to the body of the incus and the external superficial antral cells; also wall of the lateral sinus, as it hugs the posterior inferior boundary of the mastoid antrum. The position of the malleus and incus, how they lie in the tympanic attic; also the relation of the short process of the incus, to the aditus ad. antrum are all typically portrayed.

The figures indicate—



1—Tegmen
2—Mastoid Antrum. Ant. Surface
3—Lateral Sinus. External Surface
4—Malleus
5—Anterior Wall of Aditus
6—Incus
7—Tensor Tympani Muscle
8—Drum Membrane
9—Eustachian Tube

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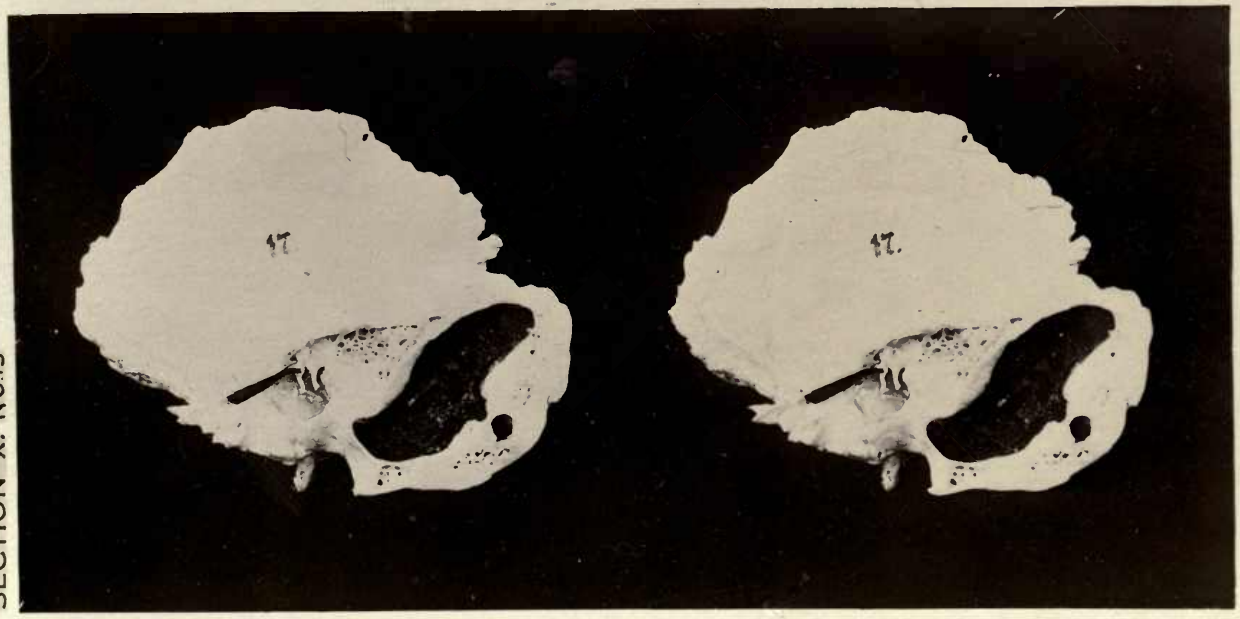
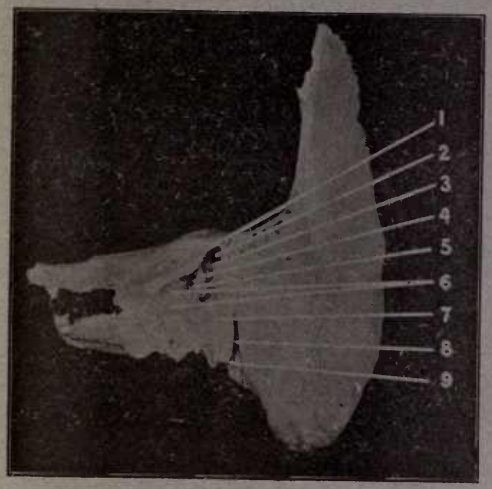


SECTION X. No.15

Section X --- No.16

OSSICULAR RELATION TO ADITUS AD. ANTRUM

This section has been sawed perpendicularly through the center of the external auditory canal, meeting a lateral sectional sawing through the eustachian tube at the posterior margin of the annular ring. The malleus, incus and stapes are in situ. The body of the incus lies in the tympanic mouth of the aditus ad. antrum. The stapes is visible just to the left of the long process of the malleus. The mastoid antrum opening shows above the body of the incus; horse-hair bristles pass through the channels of the descending facial canal and the chorda tympani.



The figures indicate—

1—Tympanic Tegmen
2—Mastoid Antrum Opening (Tympanic Mouth)
3—Incus (Body)
4—Malleus
5—Stapes
6—Eustachian Tube
7—Annular Ring
8—Horse Hair Passing Through Descending Facial Canal
9—Stylo Mastoid Foramen

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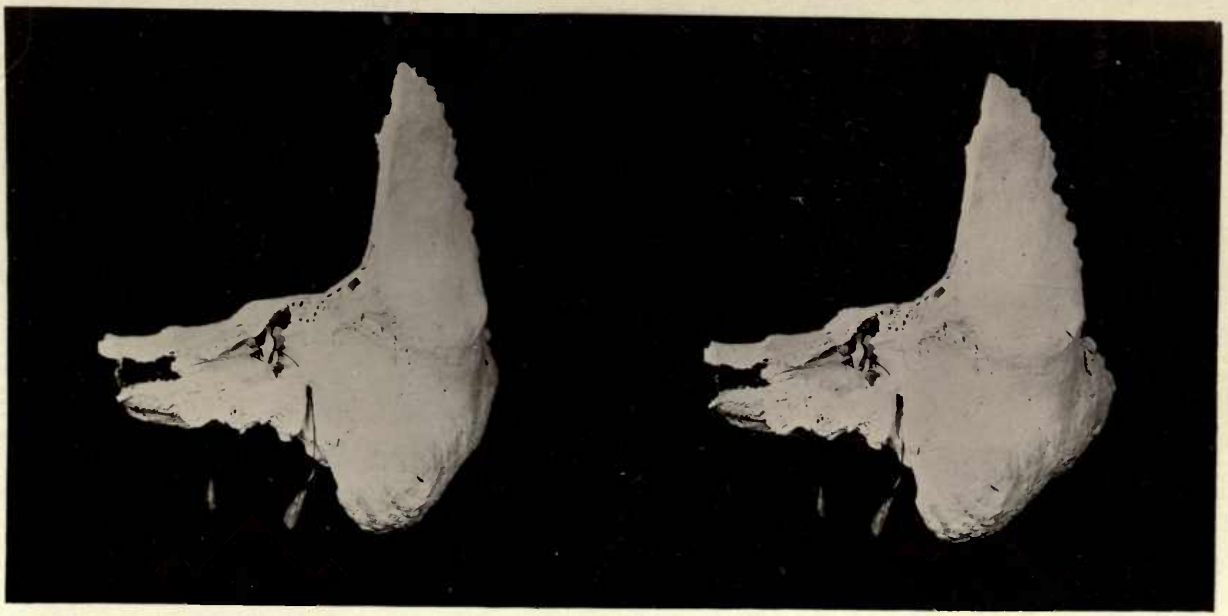

SECTION X. NO.16

VERTICAL TRANSVERSE SECTION THROUGH TYMPANUM AND MASTOID PROCESS

This specimen sawed through the same region as shown in stereogram No. 14, illustrates an abnormality, in that the lateral sinus is much more superficial and closer to the external table than is usually the case. The sinus in this relation and position is exposed by sawing the section; but well posterior.

The posterior inferior antral cells show in close proximity to the lateral sinus. The ossicles are seen resting against the posterior tympanic attic wall. The thin shell of bone above them is the typmanic tegmen. The tensor tympani muscle is exposed resting in its bony covering, forming the roof of the eustachian tube. Note the course of the descending facial canal just posterior and inferior to the ossicular chain.

The figures indicate—

1—Post. Inferior Antral Cells
2—Incus
3—Malleus
4—Stapes
5—Tensor Tympani Muscle
6—Promontory
7—Eustachian Tube
8—Section through Lateral Sinus
9—Stylo Mastoid Foramen (Facial Nerve Exit)

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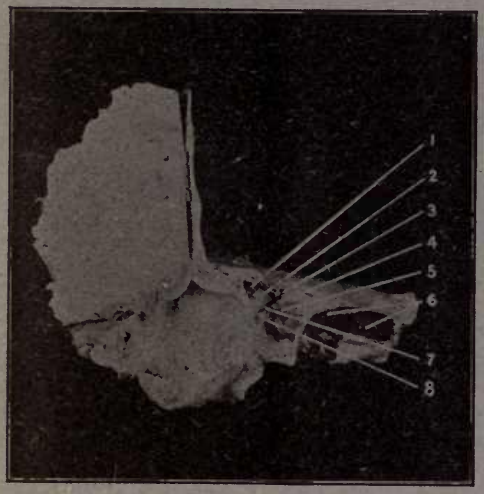
POSTERIOR TYMPANIC WALL RELATION NO. 1

This section similar to that shown in stereogram No. 15 has been sawed perpendicularly through the posterior wall of the auditory canal to the depth of the descending facial canal, meeting a lateral sawing through the eustachian tube and annular ring. The ossicular chain, malleus, incus and stapes have been removed. The entire posterior tympanic wall surface with its projections and depressions and foraminæ are shown, especially the tympanic opening of the processus cochleariformis, through which the tendon of the tensor tympani mus. emerges. The pyramid of the tympanum is shown, No. 8. Through the opening at its apex the tendon of the stapedius mus. emerges. Through the narrow slit anterior and below the tip is the foramen of the chorda tympani nerve.



The figures indicate—

1—Mastoid Antrum Opening (Tympanic Mouth)
2—Prominence of Ext. Semi-Cir. Canal
3—Tympanic Foramen of Transverse Facial
4—Tip of Proc. Cochleariformis
5—Oval Window
6—Carotid Canal. Internal Surface
7—Transverse Facial Canal
8—Pyramid

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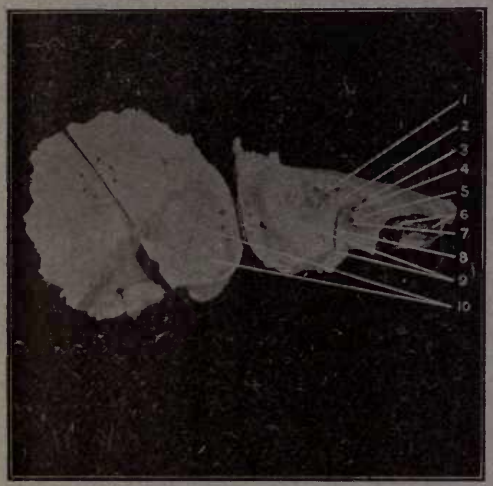
POSTERIOR TYMPANIC WALL RELATION TO FACIAL CANAL AND MASTOID ANTRUM—NO. 2

This specimen is the same as shown in stereogram No. 18. The lateral sawing through the annular ring; is further posterior and through the center of the antrum, and mastoid process. All the cells have been ablated except bounding the mastoid antrum. The descending facial canal in this specimen is a trifle shorter than usual. The transverse portion of the canal as it passes across the tympanum is also a little higher, especially at its internal tympanic turn. The mastoid antrum is partially divided into two compartments by a central cellular partition.



The figures indicate—

1—Mastoid Antrum (Cellular Isthmus)
2—Eminence of Ext. Semi-Cir. Canal
3—Ant. Tympanic Foramen of Transverse Facial Canal
4—Oval Window
5—Promontory
6—Carotid Canal, Internal Wall
7—Round Window
8—Descending Facial
9—Lateral Sinus Prominence
10—Depleted Mastoid Process

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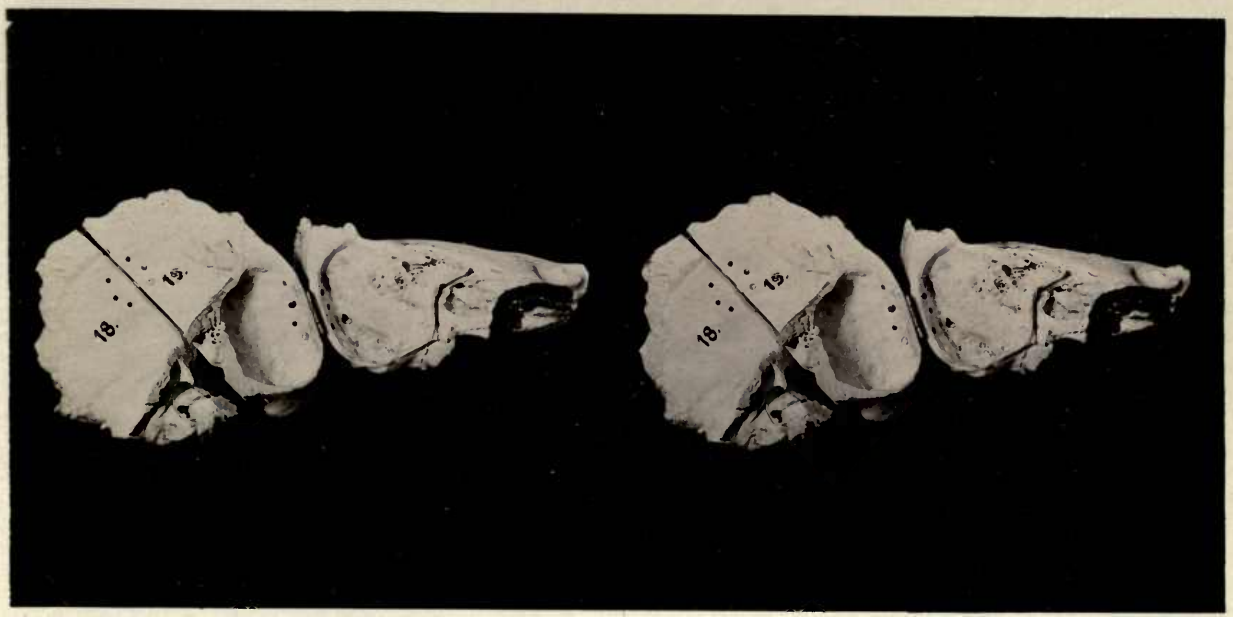
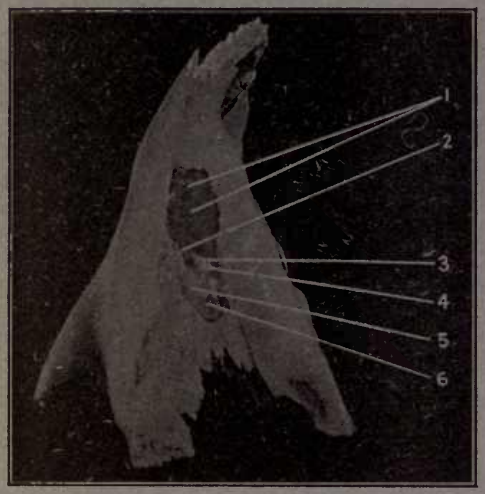


SECTION X. NO 19.

Section X --- No.20

RELATION OF OSSICULAR CHAIN TO TYMPANUM AND MASTOID ANTRUM

SUPERIOR VIEW. The bony tegmen over the antrum and tympanum is removed, exposing the bodies of the malleus, incus, antrum, and tympanum. There relation and depth are well illustrated. The cells No. 2 just to the left and above the short proc. of the incus are the internal root cells of the zygoma. Very often the first cells affected by necrosis resulting in general mastoid involvement.



The figures indicate—

1—Mastoid Antrum
2—Zygomatic Root Cells
3—Body of Incus
4—Head of Maileus
5—Ext. Auditory Canal. Tympanic End
6—Annular Ring (Inferior Surface)

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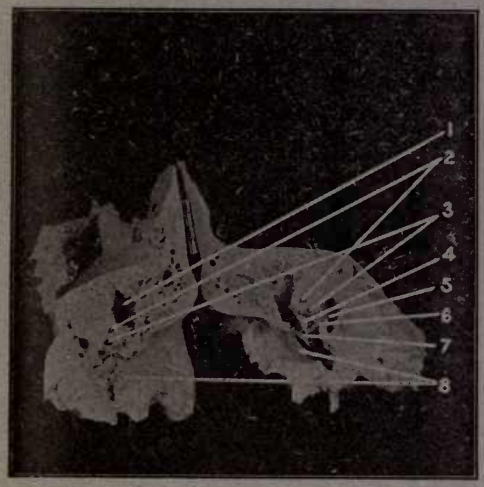
Section X --- No.21

RELATION OF OSSICLES TO VESTIBULE OF COCHLEA

PERPENDICULAR SECTION. This specimen has been sawed, perpendicularly, completely dividing temporal bone, through auditory canal, and posterior margin of the oval window. Ossicular chain in situ, shown in the right half; stapes foot plate resting in oval window, separating the tympanum from vestibule No. 5. Tympanic attic, tympanum and ossicular chain are viewed laterally. The transverse facial canal No. 3 and external semi-circular canal No. 2 are sawed through; 2 m.m. of bone separating these canals.



The figures indicate—

1—Antrum
2—External Semi-Circular Canal
3—Facial Canal
4—Incus
5—Vestibule
6—Stapes (Foot Plate)
7—Malleus
8—Annular Ring

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OSSICULAR RELATION TO TYMPANUM

(Note—Key-plate is one-half above normal size.)

TYMPANIC VIEW. Mastoid, squamous and part of petrous portion of the temporal bone have been removed, showing malleus, incus and stapes, articulated in natural position. The processus cochliariformis No. 6, facial canal No. 8 have been opened, demonstrating the regional anatomic relation of the ossicular chain.

The figures indicate—

1—Superior Semi-Circular Canal
2—Incus
3—Malleus
4—Posterior Semi-Circular Canal
5—Stapes
6—Proc Cochleariformis
7—Round Window
8—Facial Canal
9—Carotid Canal

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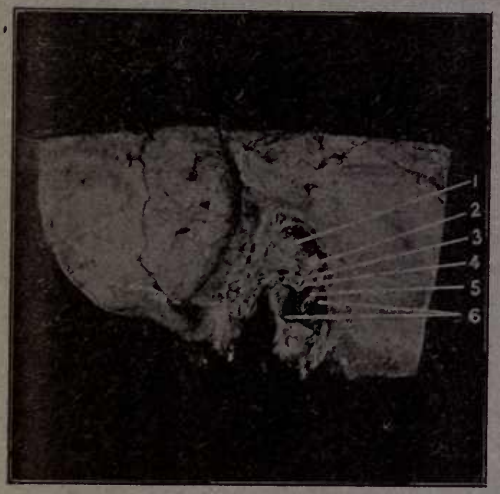
SECTION X. NO 22

OSSICULAR RELATION TO ANNULAR RING

INVERSE VIEW. The entire petrous portion of the temporal bone has been removed. The natural drum membrane is preserved with the ossicles in normal relation. The position or location of the anterior surface of the mastoid antrum is well illustrated.



The figures indicate—

1—Antrum Anterior Surface
2—Aditus Ad. Antrum Ant. Surface
3—Stapes
4—Incus
5—Malleus
6—Drum Membrane

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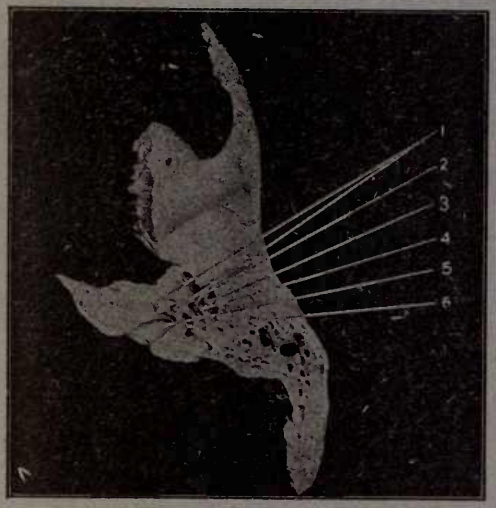
SECTION X. NO 23

RELATION OF VESTIBULE TO INTERNAL AUDITORY CANAL

INFERIOR VIEW. The lower portion of temporal bone has been removed to level of internal auditory canal, exposing vestibule of cochlea, cochlea and inferior surface of ossicular chain. The vestibule No. 6 is seen to the right and on a horizontal plane with the int. aud. canal No. 5. The cochlea No. 1 just above the auditory canal.



The figures indicate—

1—Cochlea
2—Malleus
3—Incus
4—Stapes
5—Internal Auditory Canal
6—Vestibule

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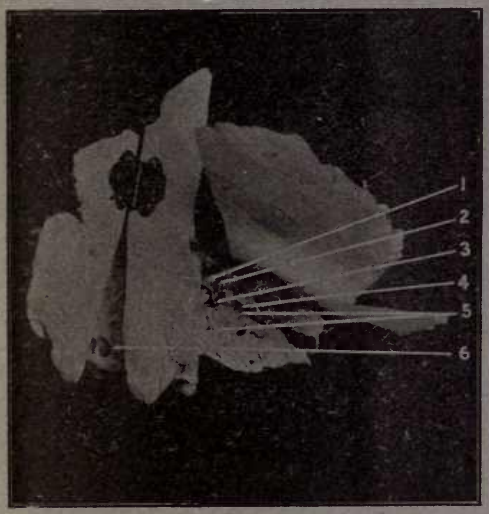
Section X --- No.25

OSSICULAR RELATION TO COCHLEA

TYMPANIC VIEW. Specimen has been sawed perpendicularly through the center of the external auditory canal, meeting a lateral perpendicular sawing through eustachian tube. The posterior tympanic wall removed exposing turns of cochlea No. 5.



The figures indicate—

1—Incus
2—Malleus
3—Stapes
4—Tensor Tympani Muscle
5—Cochlea—Three turns
6—Mastoid Tip Cells

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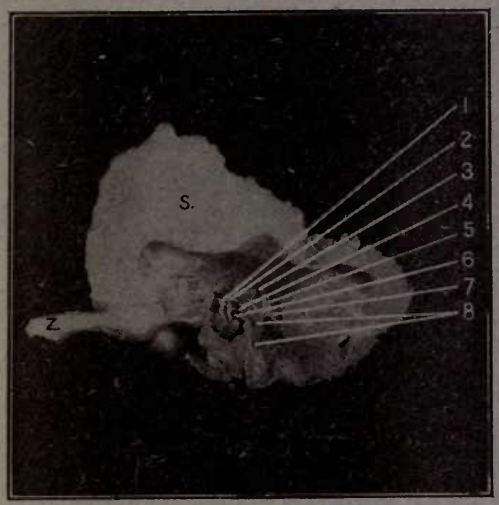
RELATION OF SEMICIRCULAR CANALS TO TYMPANUM OSSICLES AND MASTOID PROCESS

Due to an abnormal areation, dolichocephalic skull, and extensive cell deposits at the zygomatic root and above the tympanic attic, made it possible to demonstrate the ossicular chain and semi-circular canals without any photographic distortion. The malleus, incus and stapes are in natural position and articulation. All three semi-circular canals are open throughout their entire circumference. The short process of the incus lies across the junction of the anterior external bend of the superior and external semi-circular (horizontal) canals. The fallopian canal has been removed showing the transverse facial canal passing below and behind the long incal process, and the neck of the malleus. The narrow slit, posterior and slightly inferior to the post. semi-circular canal entering below the vestibule, at an angle of 45 degrees, is the aqueductus vestibuli.



The figures indicate—

1—Malleus
2—Incus
3—Superior Semi-Cir. Canal
4—Horizontal or Ext. Semi-Cir. Canal
5—Posterior Semi-Cir. Canal
6—Stapes
7—Aqueductus Vestibuli
8—Facial Nerve

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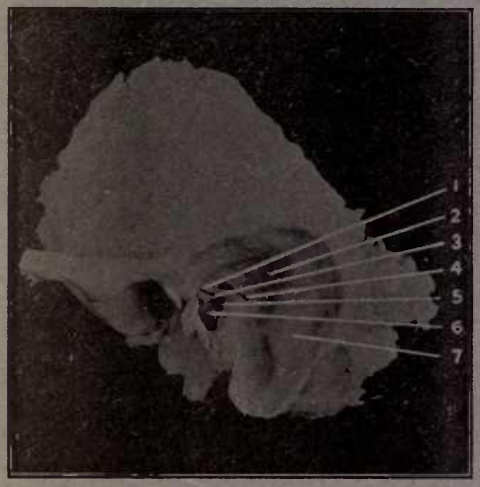
Section X --- No.27

RELATION OF EXTERNAL SEMICIRCULAR CANAL TO FALLOPIAN CANAL

A complete radical mastoid ablation has been done. The external bony covering of the external or horizontal semi-circular canal has been removed exposing this canal over two-thirds of its course. The transverse facial or fallopian canal wall has been broken through throughout in its tympanic course No. 3. The transverse facial canal is anterior and slightly superior but parallel to the external semi-circular canal. These canals are separated by a bony partition 3 m.m. thick.



The figures indicate—

1—Ant. Tympanic Facial Foramen
2—Posterior Antral Wall
3—Transverse Facial Canal (Fallopian)
4—External Semi-Circular Canal
5—Oval Window
6—Promontory
7—Lateral Sinus Eminence

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SECTION X. No.27

Section X --- No.28

RELATION OF EXTERNAL AND SUPERIOR SEMICIRCULAR CANALS TO ADITUS AND FALLOPIAN CANAL

In this specimen the regular radical operation has been performed. The zygomatic root and tympanic attic cells and all mastoid cells have been removed including the entire posterior auditory canal wall down to the tympanic or annular ring. The superior and external semi-circular canals and the fallopian canal are opened. The relation of these canals to the aditus ad. antrum floor is demonstrated.

The figures indicate—

1—Ant. Tympanic Facial Foramen
2—Superior Semi-Circular Canal
3—Opening of Vestibule
4—Ext. or Horizontal Semi-Circular Canal
5—Mastoid Antrum
6—Transverse Facial Canal (Fallopian)
7—Oval Window
8—Pyramid
9—Promontory
10—Round Window

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SECTION X. NO.28

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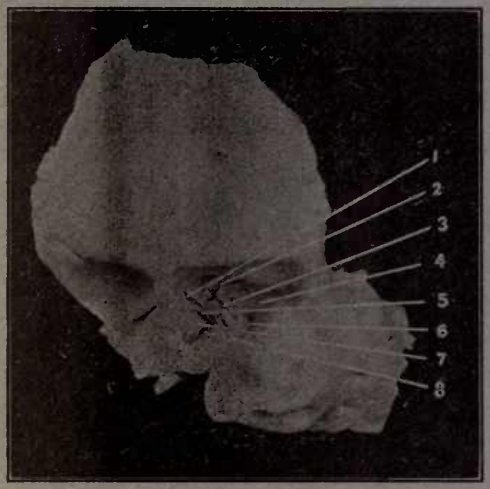
RELATION OF SEMICIRCULAR CANALS TO FLOOR OF MASTOID ANTRUM

The same preliminary ablation of the mastoid process has been done as shown in stereograms No. 27 and No. 28, with the addition of the opening of the posterior semi-circular canal. The relative position of the semi-circular canal to the mastoid antrum is illustrated. The anterior internal and inferior surface of the antrum is bounded by the semi-circulars. This technique is the method employed when operative work is indicated upon the semi-circular canal and vestibule.



The figures indicate—

1—Ant. Tympanic Facial Foramen
2—Superior Semi-Circular Canal
3—External (Horizontal) Semi-Circular Canal
4—Mastoid Antrum
5—Oval Window
6—Posterior Semi-Circular Canal
7—Promontory
8—Round Window

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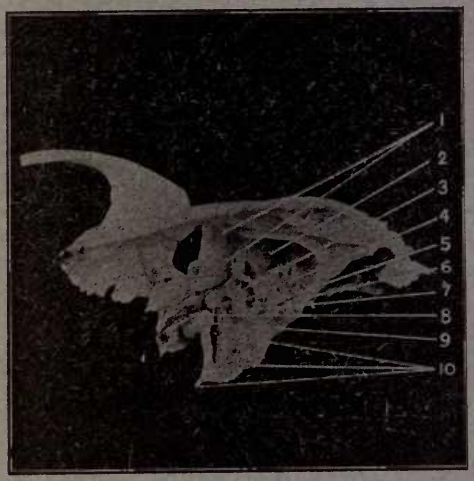
SECTION X. | NO. 29

Section X --- No.30

COCHLEA RELATION TO SEMICIRCULAR CANALS

SUPERIOR VIEW NO. 1. The entire internal superior surface of the petrous portion of the temporal bone is removed, exposing the floor of the mastoid antrum and inferior surface of the auditory canal. The external semi-circular canal is opened throughout its length, the superior sigmoidal turn of the superior semi-circular canal is demonstrated; also the external superior bony covering of the cochlea, giving its relation to the internal auditory canal and vestibule of the cochlea. The slit No. 6 passing from the region of the lateral sinus, below the mastoid cells, leading into the vestibule of the cochlea at the junction of the posterior internal turn of the superior and posterior semi-circular canals is the aquiductus vestibuli.



The figures indicate—

1—Auditory Canal (Floor)
2—Mastoid Antrum (Floor)
3—Ext. Semi-Circular Canal
4—Superior Semi-Circular Canal
5—Posterior Semi-Circular Canal
6—Aqueductus Vestibuli
7—Vestibule of Cochlea
8—Greater and Lesser Superficial Petrosal Nerve Canals
9—Superior Surface of Cochlea.
10—Internal Auditory Meatus

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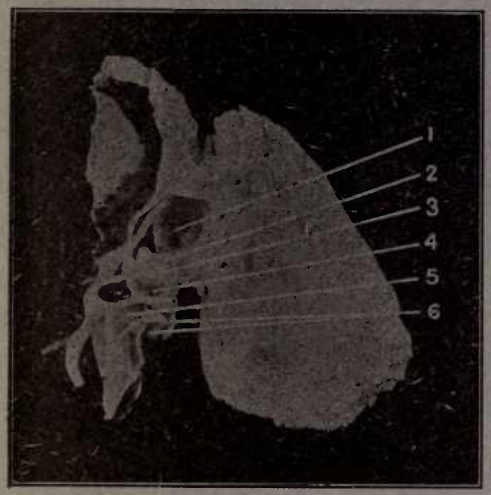
SECTION X. NO 30

COCHLEA RELATION TO SEMICIRCULAR CANALS

SUPERIOR VIEW NO. 2. All the cancellous bone surrounding the semi-circular canals, cochlea and internal auditory meatus, have been removed, leaving only the bony shell covering of the structures located in the petrous portion. Cochlea turns have been opened, including the vestibule of the cochlea. This specimen is placed in this position to give the cochlea relations to the semi-circular canals as regards depth. The cochlea and internal auditory canals lie inferior and also below and posterior to all of the semi-circular canals. The entire mastoid process and petrous portion have been exenterated, and only the flint-like bone covering, outlining the internal ear is left.



The figures indicate—

1—Depleted Mastoid Process
2—External Semi-Circular Canal
3—Superior Semi-Circular Canal
4—Vestibule of Cochlea
5—Internal Auditory Canal
6—Cochlea, two turns open.

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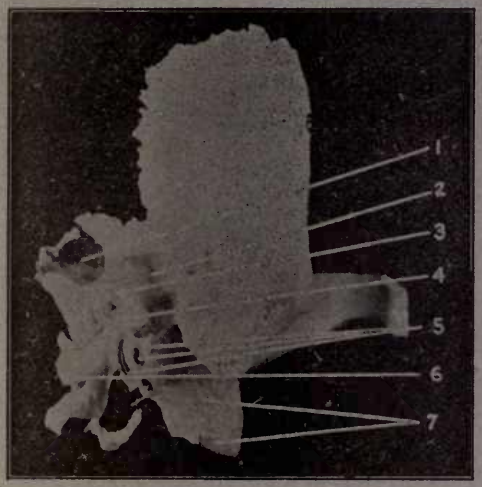
Section X --- No.32

COCHLEA RELATION TO INTERNAL AUDITORY CANAL AND SEMICIRCULAR CANALS

INTERNAL VIEW. This bone is the same as shown in stereogram No. 31, but viewed laterally. The internal tip of the petrous portion is removed. The cochlea has been drilled into; through all its circumferential turns from the tip to the base. The superior surface of the internal auditory meatus is opened, exposing the groove for the facial nerve as it passes from the anterior tympanic foramen into the internal auditory canal. The posterior lateral surface of the superior semi-circular canal is open. The base of the cochlea, and its three turns resting on the external surface of the internal auditory canal. The carotid canal passes below the base and second turn of the cochlea.



The figures indicate—

1—Lateral Sinus
2—Mastoid Antrum, Posterior Surface
3—Superior Semi-Circular Canal
4—Facial Groove, Internal Turn
5—Cochlea, three turns
6—Internal Auditory Canal
7—Mastoid Tip

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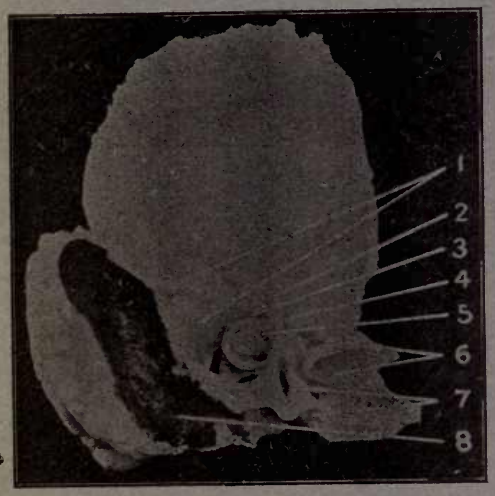
Section X --- No.33

SEMICIRCULAR CANAL RELATION TO AQUEDUCTUS COCHLEA AND INTERNAL AUDITORY CANAL

POSTERIOR VIEW. The posterior semi-circular canal is opened throughout its length. The superior and internal surface of the superior semi-circular canal No. 2 is to the right and above the posterior canal. The aqueductus cochlea No. 7 passes perpendicularly up between the posterior semi-circular canal No. 5 and posterior to the internal auditory meatus No. 6. The elliptical (lilly) shaped mouth of the internal auditory meatus is level, or slightly below and to the right of the posterior semi-circular canal.



The figures indicate—

1—Ablated Mastoid Cavity
2—Superior Semi-Circular Canal
3—External Semi-Circular Canal (Superior Surface)
4—Opening Into Vestibule
5—Posterior Semi-Circular Canal
6—Internal Auditory Meatus
7—Aqueductus Cochlea
8—Lateral Sinus

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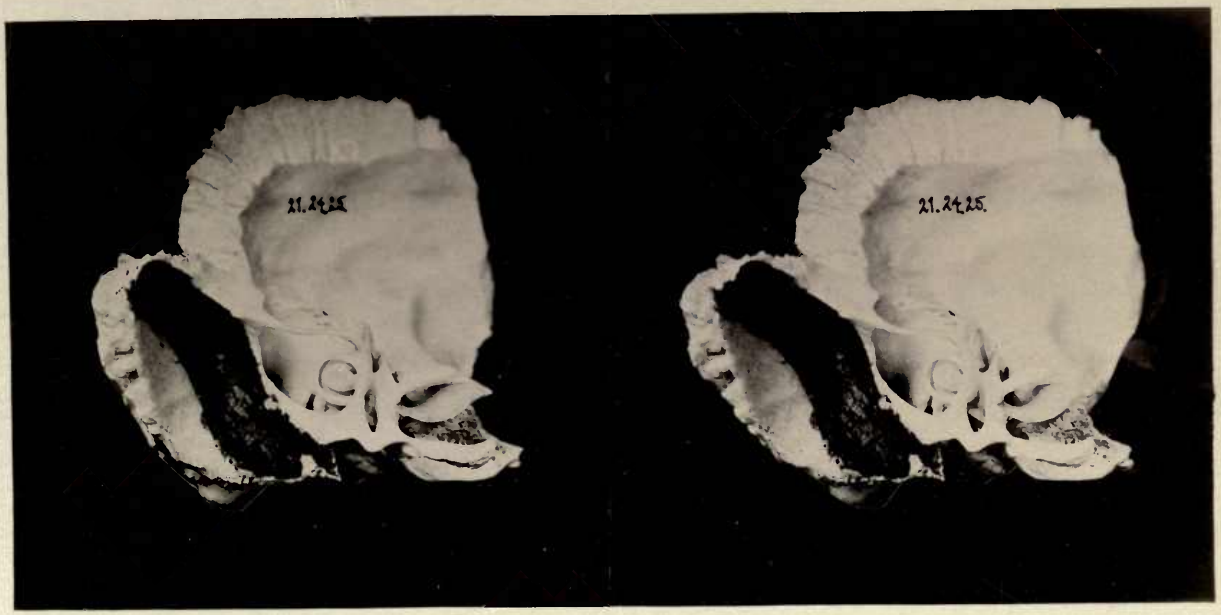
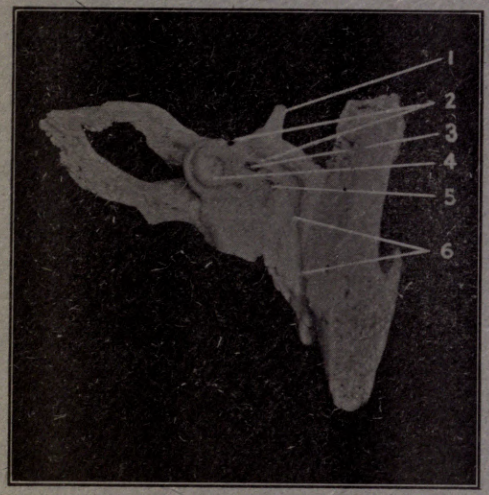


SECTION X. NO.33.

Section X --- No.34

COCHLEA RELATION TO POSTERIOR TYMPANIC WALL

This section taken to demonstrate the regional relation of the three turns of the cochlea to the posterior tympanic wall. The internal surface of the eustachian tube and cancellous bone surrounding the cochlea has been removed. The external or tympanic wall of the cochlea opened from the promontory (which is the first turn of the cochlea) to base. This specimen is of additional value, in that the maximum size of the cochlea and its location and relation to the tympanum is shown.



The figures indicate—

1—Superior Semi-Circular Canal
2—Facial Groove for Transverse Facial Nerve
3—Oval Window
4—Cochlea
5—Round Window
6—Descending Facial Canal

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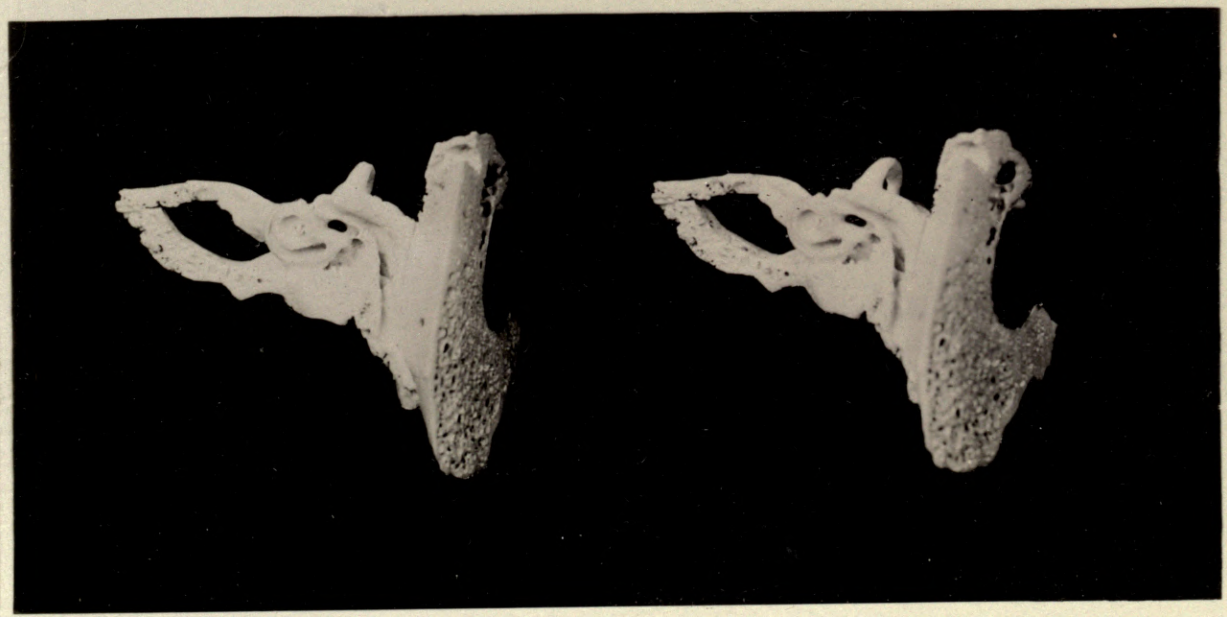
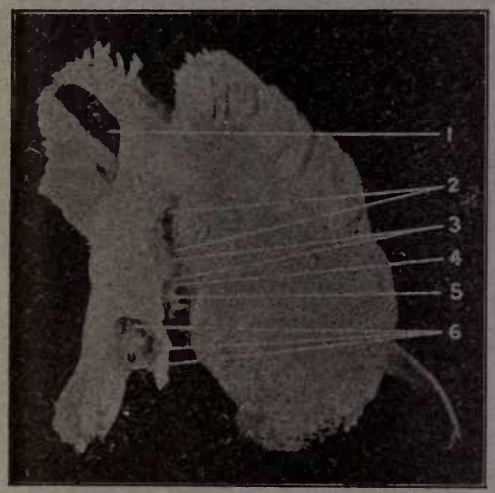


SECTION X. NO 34

Section X --- No.35

COCHLEA RELATION TO OSSICLES AND MASTOID ANTRUM

SUPERIOR VIEW. The bony antral and tympanic tegmen has been removed in this specimen. The bodies of the malleus and incus are viewed from above. The superior half of the cochlea has been drilled away, demonstrating the position of the cochlea as it lies internal in the tip of the petrous portion of the temporal bone. The three tiers or turns of the cochlea are shown. Distance from the center of the cochlea to the ossicles, 16 m.m.; the same distance from the ossicles to the mastoid antrum. The superior surface of the carotid canal is just below the cochlea.



The figures indicate—

1—Lateral Sinus
2—Mastoid Antrum
3—Aditus Ad. Antrum
4—Incus (Body)
5—Malleus (Head)
6—Cochlea (three tiers or turns)

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SECTION X. NO.35

COCHLEA RELATION TO INTERNAL AUDITORY CANAL AND VESTIBULE

HORIZONTAL SECTION. This specimen, horizontally sawed section, through the center of the auditory canal, cochlea, internal auditory canal and vestibule of the cochlea, showing tiers or turns of the cochlea and cribriform openings in the internal auditory canal for the cochlea and vestibular branches of the auditory nerve, Nos. 2 and 3. The facial and superior semi-circular canals are divided, Nos. 8 and 9. No. 7. Groove in the annular ring for the attachment of the drum membrane.

The figures indicate—

1—Cochlea
2—Cribriform openings for Coch. Branch of Auditory Nerve
3—Cribriform openings for the Vest. Branch of Auditory Nerve
4—Oval Window
5—Vestibule of the Cochlea
6—Ext. Auditory Canal
7—Annular Ring
8—Facial Canal Cut Across
9—Superior Semi-Circular Canal

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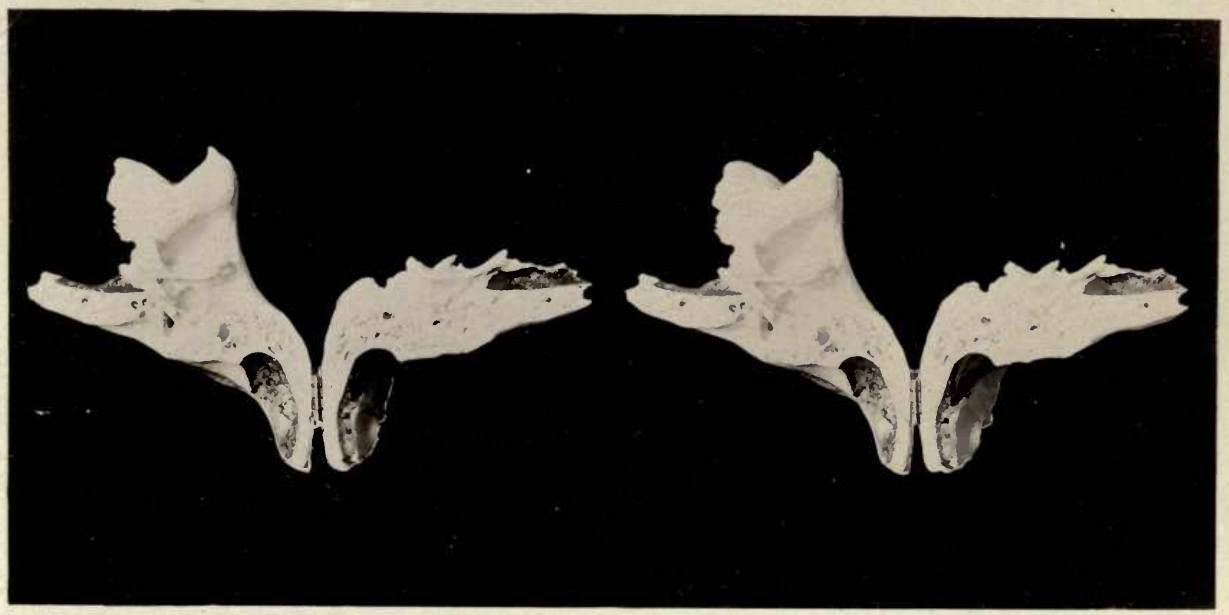

SECTION X. NO.36

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